590

ISEE-3

15 MINUTE AVERAGE FLUXES + COUNT RATES
HOURLY AVERAGE FLUXES AND COUNT RATES

78-079A-12A, 78-079A-12B

ISEE 3

15-MIN AVG FLUX: H, HE + Z 2; TAPE

78-079A-12A

THIS DATA SET HAS BEEN RESTORED. IT ORIGINALLY CONTAINED ONE 9-TRACK, 1600 BPI TAPE WRITTEN IN BINARY. THERE IS ONE RESTORED TAPE. THE DR TAPE IS A 3480 CARTRIDGE AND THE DS TAPE IS 9-TRACK, 6250 BPI. THE ORIGINAL TAPE WAS CREATED ON A PDP1 COMPUTER AND WAS RESTORED ON AN IBM 9021 COMPUTER. THE DR AND DS NUMBER ALONG WITH THE CORRESPONDING D NUMBER AND TIME SPAN IS AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN
DR004918	DS004918	D057301	1	08/13/78 - 12/01/78

ISEE 3

1-HR. AVG FLUX:H, HE &Z>2;TAPE

78-079A-12B

THIS DATA SET HAS BEEN RESTORED. ORIGINALLY IT CONTAINED FOUR 9-TRACK, 1600 BPI TAPES WRITTEN IN BINARY. THERE IS ONE RESTORED TAPE. THE DR TAPE IS A 3480 CARTRIDGE AND THE DS TAPE IS 9-TRACK, 6250 BPI. THE ORIGINAL TAPES WERE CREATED ON PDP1 COMPUTER AND THEY WERE RESTORED ON AN IBM 9021 COMPUTER. THE DR AND DS NUMBERS ALONG WITH THE CORRESPONDING D NUMBERS AND THE TIME SPANS ARE AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN
DR004833	DS004833	D057302	1	12/01/78 - 01/01/79
		D057303	2	12/31/78 - 01/01/80
		D060473	3	01/06/80 - 01/04/81
		D063973	4	01/04/81 - 01/03/82

REQ. AGENT	RAND #	ACQ. AGENT
DEW	V0187	HKH
DAD	V0262	HKH

ISEE 3

15 MINUTE AVERAGE FLUXES AND COUNT RATE

HOURLY AVERAGE FLUXES AND COUNT RATE

78-079A-12A

78-079A-12B

This data set catalog consists of 5 tapes. One tape is for data set 78-079A-12A and four tapes are for data set 78-079A-12B. The tapes are 1600 BPI, 9 track, binary and contain on file of data. The tapes were created on a PDP1 computer. The D and C numbers along with the time spans are as follows:

78-079A-12A

D#	C#	TIME SPAN
D-57301	C-23126	08/13/78 - 12/01/78

78-079A-12B

D#	C#	TIME SPAN
D-57302	C-23127	12/01/78 - ~~01/01/79~~ 12/31/78 1/1/79
D-57303	C-23128	12/31/78 - 01/01/80
D-60473	C-23662	01/06/80 - 01/04/81
D-63973	C-24098	01/04/81 - 01/03/82

PROGRESS REPORT

on the

CALTECH HEAVY ISOTOPE SPECTROMETER TELESCOPE (HIST) ON ISEE-3

(NASA Contract NAS5-20721)

1 July to 30 September 1982
1 October to 31 December 1982

Progress on HIST data analysis during the reporting period is described below. An updated HIST bibliography is also enclosed. The operation of the instrument during this period has remained unchanged.

Cosmic Ray Isotopes

During this period we completed work on two publications. The first, entitled "Samples of the Milky Way" was published in the December 1982 issue of Scientific American. Written in collaboration with M.E. Wiedenbeck of U.C. Berkeley, it focuses on the Caltech and Berkeley ISEE-3 measurements of the isotopic composition of cosmic ray Ne, Mg, and Si, and their interpretation.

A second article was completed as part of the U.S. Quadrennial Report to the IUGG (1979-1982). This article, to be published in Reviews of Geophysics and Space Physics, reviews recent progress in studying the elemental and isotopic composition of cosmic ray source material. It includes, in particular, recent ISEE-3 and HEAO-3 results.

Solar Flare Isotopes

J.D. Spalding has completed his Ph.D. thesis on the isotopic composition of solar flare nuclei. Work is beginning on an article for the Astrophysical Journal that will summarize his results.

NSSDC Submission

We have now completed production of the first two years of data (1978-1979) that we are submitting to the NSSDC. The data, which will be submitted on magnetic tape, include hourly average fluxes of H, He, and $Z \geq 3$ nuclei in several energy intervals. The documentation that will accompany this data submission is also essentially complete, with submission expected in early 1983.

SRL TECHNICAL REPORT 83-1

DATA SUBMISSION TO THE NSSDC
FROM THE CALTECH HEAVY ISOTOPE SPECTROMETER TELESCOPE
ON ISEE-3

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E. C. Stone

R. E. Vogt

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Pasadena, California 91125

February, 1983

Contents

I. Introduction

Caltech is furnishing data to the NSSDC from the Heavy Isotope Spectrometer Telescope (HIST) on ISEE-3. The data consist of counting rates and absolute fluxes for hydrogen and helium nuclei, and counting rates for $Z \geq 3$ nuclei, in several energy intervals. Other related data is also provided. The data are averaged over 1-hour time intervals, except for the first 3 and 1/2 months following launch, for which 15-minute averages are provided. This report describes the HIST experiment and the data provided. A bibliography is included for the reader who wishes additional information.

HIST is designed to measure the isotopic and elemental composition, and the energy spectra, of solar, galactic, and interplanetary cosmic-ray nuclei for the elements from H through Ni (Z=1 to Z=28) in the energy range from ~3 to ~250 MeV/nucleon. The results of these measurements are important to studies of studies of the composition of solar matter and galactic cosmic-ray sources, the study of nucleosynthesis processes, studies of particle acceleration and propagation, and studies of the life history of cosmic rays in the heliosphere and in the galaxy. The principal investigator for the HIST experiment is E. C. Stone, with R. E. Vogt as co-investigator.

II. Instrument Description

A. The Telescope

The HIST instrument consists of a telescope of solid-state detectors and associated signal-processing electronics, as described in Althouse *et al.* (1977). The telescope consists of 11 silicon solid-state detectors of graduated thicknesses, as summarized in Table 1 and shown schematically in Figure 1. A unique feature of HIST is the use of position sensitive detectors, M1 and M2, which allow the determination of the trajectory of incident particles. M1 and M2 are 50 μm-thick surface-barrier devices with a matrix of strips forming an x-y hodoscope. There are 24 parallel "x" strips on one side of the detector, and, orthogonal to these, 24 "y" strips on the other side. The strips are spaced at 1 mm intervals. Each strip of M1 or M2 is connected to a charge-sensitive preamplifier, shaping amplifier, and threshold discriminator. In addition, signals from the strips of one side of each detector are summed and digitized by two 4095-channel analog to digital converters (ADCs).

Detectors D1, D2, and D3 are conventional surface-barrier detectors, while D4 to D9 are double-grooved Li-drifted detectors with a central area for measuring energy loss and an annular guard (G) used as an anticoincidence shield. Detectors D1, D2, D3, and the centers of D4 through D8 are each direct coupled to separate charge-sensitive preamplifiers, shaping amplifiers, and 4095-channel ADCs. The center of D9 and the guard regions of D4 through D9 are each connected to preamplifiers, shaping amplifiers, and discriminators. Each guard signal channel has two discriminators; G1 is sensitive to minimum ionizing particles, while G2 will trigger only on nuclei with more than 5 MeV energy loss.

The telescope is covered by two windows that protect the detectors from sunlight and provide an electrical shield. The outer window is a 6 μm-thick aluminum foil (1.40 mg/cm^2), while the inner window is 12.7 μm aluminized-Mylar (1.6 mg/cm^2).

B. Analysis Modes

For particles which stop in detectors M2 through D8, the residual energy E′ is measured in the stopping detector, and the energy losses ΔE are measured in up to four preceding detectors (see Table 2). In this report we label the "Range" of an event by the identification of the last detector triggered. Thus, for example, particles stopping in M2 are labeled Range 0, while particles stopping in D1 are labeled Range 1, and so forth.

Because the telemetry rate is insufficient to transmit pulse-height-analysis (PHA) information for every event during periods of high count rates, a priority system selects a sample of the most interesting events for transmission. Highest priority is given to stopping particles with $Z \geq 3$, as identified by the pulse heights in the last two detectors triggered. For these "HiZ" events the priority system has a "rotating" feature that assures that each Range is equally represented in telemetry. For particles that penetrate D9, the energy losses ΔE are measured in D5 through D8; these particles and stopping particles with $Z < 3$ ("LoZ") are given lower priority. The requirements for these event types are summarized in Table 3.

HIST also accumulates "rate" data which is used to normalize particle fluxes and monitor instrument health. Rate accumulators are used to monitor events of various types during 64 second intervals, and to monitor individual detector count rates. Some of these rates are subcommutated, such that they are accumulated over 1 out of 8, or 1 out of 24 of the 64 second intervals. There are 16 rates which are counted separately in eight directional sectors of spacecraft rotation. These sectored rates include stopping HiZ events summed over Ranges 0 to 8, and the instrument live time in each of the 8 sectors.

C. Orientation on the Spacecraft

The telescope acceptance direction (telescope axis) is oriented perpendicular to the spacecraft spin axis, which is approximately normal to the ecliptic, so that the instrument scans the particle fluxes in ecliptic as the spacecraft spins. The ecliptic plane is divided into 8 equal sectors and each event is tagged according to its sector of incidence.

III. History of Instrument Operation

A. Instrument Reconfiguration

ISEE-3 was launched on 8/12/78 into a heliocentric orbit 0.99 AU from the sun. HIST was turned on initially on 8/13/78. The experiment operated normally from 8/13/78 to 12/1/78, with element and isotope resolution for $1 \leq Z \leq 28$ nuclei consistent with its design specifications. On 12/1/78, after 110 days of operation, HIST experienced a component failure in its read-out logic, with the result that a portion of the data bits associated with each analyzed event were no longer transmitted to earth. In particular, one half of the PHA bits were no longer transmitted, and the hodoscope information was also degraded. The counting rate data was not affected by this failure. In order to limit ambiguities in the interpretation of the event data, HIST was commanded into a reconfigured mode in which it functions as an element spectrometer (abundant elements with $1 \lesssim Z \lesssim 26$) having somewhat reduced geometry factor and energy coverage.

Table 4 summarizes the instrument's operation history. Note that during time periods 3 and 4 some of the M1 and M2 strips were commanded off, which has the effect of providing a clean, well-defined geometry, with somewhat reduced collecting power. Note also that following 79:053:1825 detectors D6, D7, and D8 were disabled by command. This reduced the energy coverage of the instrument, but does not affect any of the data submitted to the NSSDC.

B. HIST Geometry Factors

Table 5 summarizes HIST geometry factors for events with Range 0 through Range 4, as a function of the instrument's operation status (see Table 4). The geometry factors for Periods 1 and 2 are somewhat different from (and supersede) those in Althouse _et al_. (1977) because measured (rather than nominal) detector parameters were used in their calculation. Table 5 includes only those Ranges used for the NSSDC data submission; it is these values that were used in calculating the absolute fluxes that are being submitted from HIST.

It should be emphasized that the component failure on 12/1/78 affected only the data bits associated with individual pulse-height analyzed events; it did not affect the counting rate data (e.g., the LoZ and HiZ rates, see Section IV). Note, however, that the counting rate data are also governed by the geometry factors in Table 5, and that _no_ corrections have been applied to these raw counting rate data to correct for changes in the instrument configuration.

IV. _Description of the Data_

The data submitted from HIST consists of time-averaged counting rates and absolute fluxes over several energy intervals. For the first 110 days following launch (Period 1 in Table 4) 15-minute averages are provided; for all subsequent time periods the quantities are averaged over 1-hour intervals.

A. Counting Rate Data

A total of 18 time-averaged counting rates are provided. Of these, 11 (the LoZ and HiZ rates) have a well-defined and generally useful physical interpretation, while the remaining 7 can be categorized as engineering rates. All rate data have been corrected for instrumental deadtime using HIST's built-in live-time monitor. The uncertainties given are statistical.

Table 6 summarizes the energy intervals over which the LoZ and HiZ rates respond. Note that the LoZ rates respond only to Z=1 and Z=2 nuclei (typically dominated by protons), while the HiZ rates respond only to $Z \geq 3$ nuclei (typically dominated by CNO nuclei). Table 6 also gives the coincidence requirements for each rate. Note that because they all require that both M1 and M2 trigger (300 keV thresholds for ~50 μm-thick detectors) these rates are extremely insensitive to electrons of all energies. However, this requirement also affects the proton detection efficiency at energies greater than ~12 MeV. Thus the proton detection efficiency of the Range 4 LoZ rate (LoZ R4) varies from ~1 at 12 MeV to <0.1 at ~20 MeV. The geometry factors appropriate to these rates are listed in Table 5. The user is again reminded that these geometry factors are not the same for all time periods (see Tables 4 and 5), and that no corrections have been applied to the counting rates for these changes. Figure 3 shows an example of some of the HIST rate data during a solar active period.

Table 6 also includes the duty cycle for the LoZ and HiZ rates. The LoZ rates by range were accumulated sequentially over every eighth 64-second interval (e.g., during the first 64-second interval HIST counted LoZ R0 events; during the second interval LoZ R1 events; and so forth). Thus the time intervals for the individual LoZ rates (by Range) do not coincide. The LOZSUM rate (see Table 10), which has a duty cycle of 1, sums over all Ranges that are operational (from 0 to 8), but is typically dominated by the first few Ranges. Note that (within the limitations of the statistics of small numbers) the LOZSUM rate should be somewhat greater, but approximately equal to, the sum of the LoZ rates from Ranges 0 to 4. Because of data gaps, it is possible that a particular LoZ rate (by Range) was not counted at all during a given time interval. For data to be reported from a given time interval, it was required that $\geq$ 8 minutes of data be available from the 15-minute time intervals (Period 1 in Table 4) and that $\geq$16 minutes of data be available from the 1-hour intervals (Periods 2,3, and 4).

The other counting rate data provided consist of single detector counting rates for M1, M2, and D1 through D5. These rates are primarily of engineering value. For example, if one of these detectors were to become noisy (as indicated by an increased and irregular counting rate during quiet times) this condition could lead to chance coincidences with normal events (relevant resolving time is a few microseconds) and thereby distort the Range distribution of LoZ and HiZ nuclei.

The user is warned that there are occasional bit errors on the HIST data tapes received by Caltech that may affect the counting rate data. Although the rate data were "filtered" to check for and discard obvious bit errors leading to impossible or inconsistent counting rates, no "trend checking" was done, and it is likely that some bit errors have gone undetected. These can only be identified by looking for isolated anomalies that deviate from the trend of the data.

B. Absolute Flux Data

The second type of data provided consists of absolute fluxes of hydrogen and helium nuclei in several energy intervals ranging from ~2 to ~20 MeV/nucleon. These fluxes were obtained using the PHA data to identify the relative abundances of H and He nuclei; the geometry factors in Table 5; and the LoZ counting rates to normalize the the absolute fluxes. Table 7 summarizes the energy intervals for which absolute fluxes are provided; these intervals are determined by the various Ranges within HIST. Absolute fluxes for H nuclei with ~12 to ~20 MeV are not reported because protons in this energy interval are not fully efficient at triggering M1 and M2, as discussed above.

During Period 1 (see Table 4) H and He nuclei were identified in the conventional manner by counting the number of events within the appropriate regions of the two-dimensional PHA matrices formed from the pulse heights of the last two triggered detectors. For data from subsequent Periods, similar methods were developed, using the available PHA bits from the last 2 (or in some cases 3) triggered detectors. These algorithms were found to give satisfactory resolution of H, He, and also heavier abundant elements. Figure 2 shows a comparison of the two methods, using data from the large solar flare that occurred on September 24, 1978 (during Period 1). The H and He points labeled HIST-I use the original element identification scheme and the full HIST geometry. The points labeled HIST-II use only those events within the 16x16 matrix of M1 and M2 strips that are active during Period 4 (see Tables 4 and 5). In addition, the HIST-II fluxes are based on the new element identification methods, and use only those PHA bits still available during Periods 2, 3, and 4. Thus the effect of the failure was simulated. As can be seen in Figure 2, the two methods are in good agreement. While there are small differences visible between the He fluxes derived from the two methods, the differences are in all cases <10% when the small changes in the energy intervals involved are taken into account.

Several intermediate quantities used in calculating the H and He fluxes are included on the tape so that the user can reproduce these values, or combine data over longer time intervals if desired. In particular, the number of events of each type and the instrument live time for LoZ events are provided for each time interval. Note that the live times can become very small during periods of high count rates because not all events that trigger the instrument can be telemetered. Also given is the "multiple hodoscope" (MH) event fraction, that is, the fraction of events that trigger 2 or more non-adjacent strips on either M1 or M2. During quiet times this fraction is very low (<1%), but it may increase dramatically during intense solar events due to the occurrence of chance coincidences of 2 or more particles. Such MH events are identified by HIST and tagged, but were not included in the flux calculation. Instead, these events were counted (by Range) and a correction factor applied to the H and He fluxes from each Range. Although summed over all Ranges, the MH event fraction on the tape should closely approximate the fraction for the individual Ranges.

V. Tape Format

This section describes the format of the HIST data on the magnetic tapes submitted to the NSSDC. These tapes contain small logical records called "Chapters" packed into long physical records. For the purposes of this report, a Chapter is defined by a "KEY" value stored in the first two-byte word of the chapter and a chapter length, specified in this document. The four different types of Chapters appearing on the tapes are listed in Table 8, and their format and contents described in Tables 9 through 12.

The physical record length varies but is always less than 8000 bytes. The first record on a tape contains ten Chapter 0's (i.e., Chapters with a KEY value of 0, see Table 9), each of which is 64 bytes long. Following the Chapter 0's in the first record are 28 Chapter 36's (described in Table 10) and finally a 4-byte Chapter 101 (Table 11) which flags the end of data in that physical record. Following records contain only the Chapter 36's and 101's until the last record, which has a string of 4-byte Chapter 103's (Table 12) which flag the logical end-of-tape. A double end-of-file follows the last record.

It is our intention to submit one tape per year of data from HIST. We have, however, made an exception for 1978, where the first tape (HIST78.1) consists of 15-minute averages, and includes data obtained before the malfunction of the HIST readout logic; while the second tape (HIST78.2) consists of 1-hour average data obtained following this malfunction. In general, the time period covered by each tape will not start (or end) exactly at the beginning (or end) of the year (but should be within 1 or 2 days of this time), because the time boundaries were dictated by the boundaries of the experiment tapes received from the ISEE Project.

VI. Acknowledgements

A number of individuals made essential contributions to the data analysis task described in this report. The software necessary to produce the NSSDC tapes was written by N. Collins, B. Gauld, J. Kuyper, and S. Mjolsness, and the tape production was handled by R. Burrell. H. Breneman and J. Spalding made essential contributions to HIST data analysis procedures used here, while W. Althouse and M. Smith provided important consultation on the operation of the HIST instrument. We also thank T. Garrard for helpful advice. This work was supported in part by the National Aeronautics and Space Administration under Contract NAS5-20721 and Grant NGR 05-002-160.

Table 1 - HIST Telescope Characteristics

Detector	Nominal Thickness (μm)	Nominal Area (mm^2)	Discrim. Threshold (MeV)	ADC Thresh. (MeV)	ADC Full Scale (GeV)
M1	50	505	0.30	0.46	0.49
M2	50	505	0.30	0.46	0.49
D1	90	600	0.19	0.54	0.92
D2	150	800		0.71	1.2
D3	500	800		1.46	2.5
D4	1700	920[1]		2.76	4.7
D5	3000	920[1]		3.64	6.2
D6	3000	920[1]		3.64	6.2
D7	6000	920[1]		5.41	9.2
D8	6000	920[1]		5.41	9.2
D9	3000	920[1]	0.19	-	-

[1]Area given is for central detection region. In addition there is an annular guard region of $\sim$ 450 mm^2 area (see text).

Table 2 - HIST "Ranges"

Range	Last Detector Triggered	Coincidence Requirement[1]	Pulse Heights Telemetered
0	M2	$M \cdot \overline{D1} \cdots\cdots \overline{D9}$	M1, M2
1	D1	$M \cdot D1 \cdot \overline{D2} \cdots \overline{D9}$	M1, M2, D1
2	D2	$M \cdot D2 \cdot \overline{D3} \cdots \overline{D9}$	M1, M2, D1, D2
3	D3	$M \cdot D3 \cdot \overline{D4} \cdots \overline{D9}$	M1, M2, D1, D2, D3
4	D4	$M \cdot D4 \cdot \overline{D5} \cdots \overline{D9}$	M1, D1, D2, D3, D4
5	D5	$M \cdot D5 \cdot \overline{D6} \cdots \overline{D9}$	M1, D2, D3, D4, D5
6	D6	$M \cdot D6 \cdot \overline{D7} \cdots \overline{D9}$	M1, D3, D4, D5, D6
7	D7	$M \cdot D7 \cdot \overline{D8} \cdot \overline{D9}$	M1, D4, D5, D6, D7
8	D8	$M \cdot D8 \cdot \overline{D9}$	M1, D5, D6, D7, D8
9	D9	$M \cdot D9$	M1, D5, D6, D7, D8

[1] Where M is defined as $M1X \cdot M1Y \cdot MZX \cdot MZY$

Table 3 HIST Event Types

Coincidence Requirement	Description
$M1X \cdot M1X \cdot M2X \cdot M2Y \cdot Z3 \cdot \overline{D9} \cdot \overline{G2}$	Stopping, $Z \geq 3$
$M1X \cdot M1Y \cdot M2X \cdot M2Y \cdot \overline{Z3} \cdot \overline{D9} \cdot \overline{G1}$	Stopping, $Z < 3$
$M1X \cdot M1Y \cdot M2X \cdot M2Y \cdot D9 \cdot \overline{G2}$	Penetrating, $Z \geq 2$

M1X = logical OR of all M1X strip discriminators

Z3 = 1 for stopping particles with $Z \geq 3$

= 0 otherwise (computed from ADC pulse heights)

Table 4 - Summary of HIST Operation

Time Period	Start	End	Comments
1	Launch	78:335:2019	Normal Operation
2	78:335:2020	79:053:1824	Not all "event data bits transmitted after this time. "Rate" data unaffected.
3	79:053:1825	79:079:2232	Detectors D6, D7, D8, turned off. M1 reduced to 16 x 16 strips. M2 reduced to 8 x 8 strips.
4	79:079:2233	present	Detectors D6, D7, D8 turned off. Both M1 and M2 changed to 16 x 16 strip arrays.

Table 5 - HIST Geometry Factors (cm^2sr)

Last Detector Triggered[1]	Range	Time Period[2] 1,2	3	4
M2	0	0.79	0.063	0.25
D1	1	0.73	"	"
D2	2	0.73	"	"
D3	3	0.72	"	"
D4	4	0.70	"	"

[1] All previous detectors must also trigger

[2] Time periods defined in Table 4

Table 6 - Counting Rate Energy Intervals (in MeV/nucleon)

Range	LoZ ^{1}H	^{4}He	Duty Cycle	HiZ[1]	Duty Cycle
0	2.3 - 3.2	2.2 - 5.1	1/8	4.3 - 6.4	1
1	3.2 - 4.8	3.1 - 4.7	1/8	6.4 -10.0	1
2	4.8 - 6.9	4.7 - 6.6	"	10.0 -14.3	1
3	6.9 -11.8	6.6 -11.3	"	14.3 -24.6	1
4	11.8 -20.9[2]	11.3 -20.4	"	24.6 -45.6	1

[1] Energy intervals listed are for ^{16}O

[2] Proton efficiency < 100% and spectral dependent

Table 7 - Absolute Flux Energy Intervals[1]

Range	Time Period 1 Hydrogen	Time Period 1 Helium	Time Period 2,3,4 Hydrogen	Time Period 2,3,4 Helium
0	2.3 - 3.2	2.2 - 3.1	2.3 - 3.2	2.3 - 3.1
1	3.2 - 4.8	3.1 - 4.7	3.2 - 4.8	3.2 - 4.7
2	4.8 - 6.9	4.7 - 6.6	4.8 - 6.9	4.7 - 6.6
3	6.9 - 11.8	6.6 - 11.3	6.9 - 11.8	6.8 - 11.0
4	———	11.3 - 20.4	———	11.3 - 20.4

[1] Energy intervals (in MeV/nucleon) are for ^{1}H and ^{4}He, which dominate the H and He fluxes.

Table 8 - Index of Chapters

Chapter Number	Chapter Name	Length (bytes)	Comments
0	CNTRL	64	Header Information
36	HISTDC	276	Time, Status, and Data
101	EOR	4	Flags end of Physical tape record
103	EOT	4	Flags end of data on tape

Table 9 - Format and Contents of Chapter 0 (CNTRL)

Item Name	Item Length (bytes)	Relative Index (bytex)	Date Type	Comments
KEY	2	0	I	KEY = 0
Spare	2	2	A	Spare
PVRS	8	4	A	Program version date
EXDT	8	12	A	Execution date
TPNM	8	20	A	Tape name
Spare	4	28	_	Spare
CHNO	2	32	I	Irrelevant
CHLN	2	34	I	"
VPNT	12 x 2	58	I	"
VRCN	2	60	I	"
Spare	2	62	_	Spare
		64		

Table 10 - Format and Contents of Chapter 36 (HISTDC)

Item Name	Item Length (bytes)	Relative Index (bytes)	Date Type	Comments
IYR	2	0	I	Year - 1900 (IYR ≥ 78)
IDY	2	2	I	Day of year (1≤ IDY ≤ 366)
IHR	2	4	I	Hour of day (see note 1)
ITIME	4	6	I	= IHR + 100 x IDY + 100,000 x IYR[2]
IMODE	2	10	I	HIST operation mode (0-4)[3]
HCNT	4 x 4	12	I	Number H events (Range 0 to 3)[4]
HECNT	5 x 4	28	I	Number He events (Range 0 to 4)[4]
LOZSUM	4	48	R	LoZ rate (summed over Ranges)[5,6,7]
LoZ	5 x 4	52	R	LoZ rates (Range 0 to Range 4)[5,6]
HIZ	5 x 4	72	R	HiZ rates (Range 0 to Range 4)[5,6]
M	2 x 4	92	R	M1, M2 single detector rates[5]
D	5 x 4	100	R	D1 to D5 single detector rates[5]
ULOZSUM	4	120	R	Uncertainty[8] in LOZSUM rate
ULOZ	5 x 4	124	R	Uncertainties[8] in LOZ rates
UHIZ	5 x 4	144	R	Uncertainties[8] in HIZ rates
UM	2 x 4	164	R	Uncertainties[8] in M rates
UD	5 x 4	172	R	Uncertainties[8] in D rates
HFLX	4 x 4	192	R	Flux[9] of Ranges 0 to 3 Hydrogen
HEFLX	5 x 4	208	R	Flux[9] of Ranges 0 to 4 Helium

(continued on next page)

Table 10 - continued

Item Name	Item Length (bytes)	Relative Index (bytes)	Date Type	Comments
UHFLX	4 x 4	228	R	Uncertainties[10] in HFLX
UHEFLX	5 x 4	244	R	Uncertainties[10] in HEFLX
LZLT	4	264	R	Live time for analyzed LoZ events in seconds
MHF	4	268	R	Multiple hodo scope event fraction[11] (≤ 1.0)
		272		

Notes to Table 10:

1) For Period 1 (see Table 4), for which 15-minute averages are provided, IHR = 10 + hour + IQH, where IQH is the quarter hour ($0 \leq \text{IQH} \leq 3$).

2) For Period 1, ITIME = (IHR/10) + 100 x IDY + 100,000 x IYR.

3) IMODE = 1 to 4 corresponds to data from Time Periods 1 to 4 (see Section III and Tables 4 and 5). IMODE = 0 means insufficient data for this period.

4) See Tables 5 and 7 for energy intervals and geometry factors.

5) All rates (and uncertainties) in units of counts/sec.

6) See Tables 5 and 6 for energy intervals and geometry factors.

7) LOZSUM is summed over all operational Ranges (see Table 4). It is typically dominated by protons in the first few Ranges.

8) All uncertainties are statistical, based on the square root of the number of counts. If there were no counts, the corresponding rate = 0.0 and the uncertainty is derived from an upper limit of 1.86 counts. If there was no data available for this rate, both the rate and uncertainty are set = 0.0.

9) All fluxes and uncertainties are in units of particles per $cm^2 \cdot ster \cdot sec \cdot MeV/nucleon$. They are based on the event counts in HCNT and HECNT. See also Tables 5 and 7.

10) Flux uncertainties are statistical, based on the square root of the number of analyzed events. If no events were analyzed the flux is set = 0.0 and the uncertainty is derived from an upper limit of 1.86 events.

11) See explanation of multiple hodoscope events in Section IV.

Table 11 - Format and Contents of Chapter 101 (EOR)

Item Name	Item Length (bytes)	Relative Index (bytes)	Date Type	Comments
KEY	2	0	I	KEY = 101
RECNO	2	2	I	Record Number

Note: This Chapter flags end of physical tape record

Table 12 - Format and Contents of Chapter 103 (EOT)

Item Name	Item Length (bytes)	Relative Index (bytes)	Date Type	Comments
KEY	2	0	I	KEY = 103
RECTOT	2	2	I	total records on tape
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Figure Captions

Figure 1: A schematic drawing of the HIST telescope. M1, M2, and D1 through D9 are all solid-state detectors described in Section II. M1 and M2 are position-sensitive devices. The annular regions of D4 through D9 (shaded regions marked G) are "guard" regions used in anticoincidence. The trajectory of a typical Range 3 event is indicated.

Figure 2: Solar-flare energy-spectra for protons (p) and alpha-particles (α) averaged over the time period 1978:266:0000 to 1978:271:0540. The plotted fluxes were calculated using both the original geometry factor and nominal PHA data (HIST-I), and using the reduced geometry factor, the PHA data, and the slightly reduced energy intervals appropriate to Period 4 (HIST-II, see discussion in Sections III and IV).

Figure 3: An example of HIST counting rate data for a solar-active period in 1981. Shown are LoZ rates from Range 0 and Range 3 (upper 2 traces) and also HiZ rates from the same two ranges (lower 2 traces).

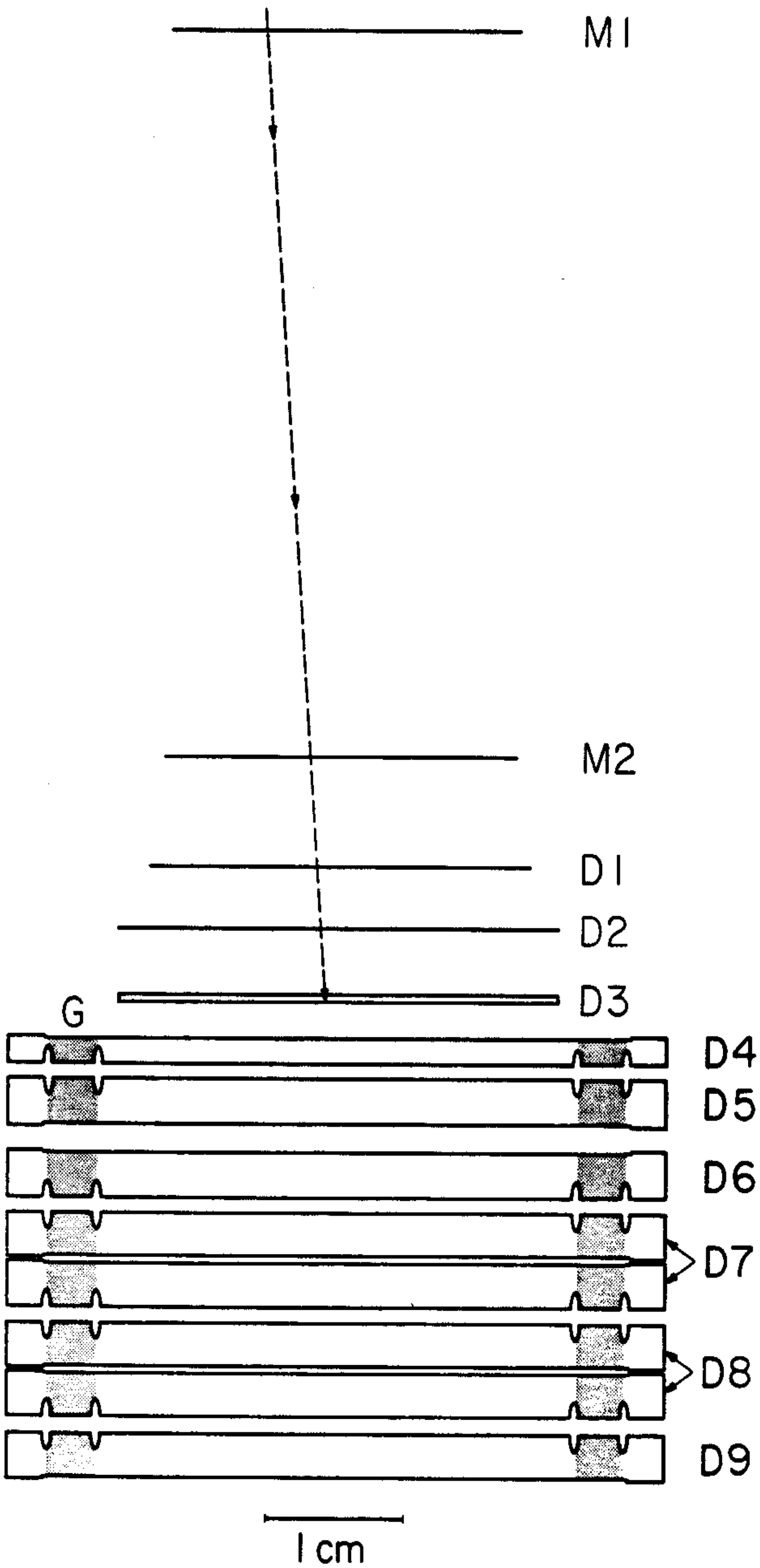
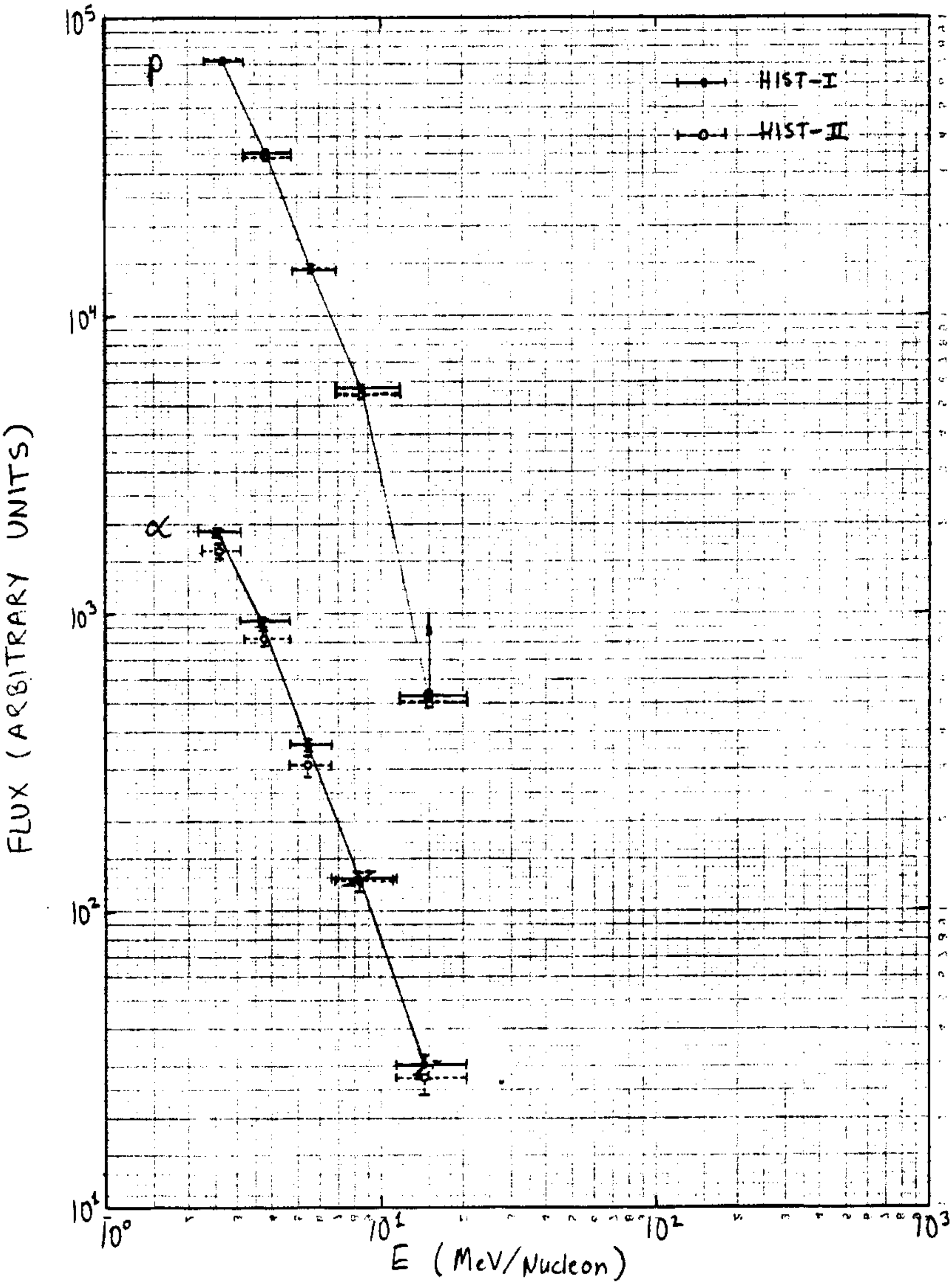
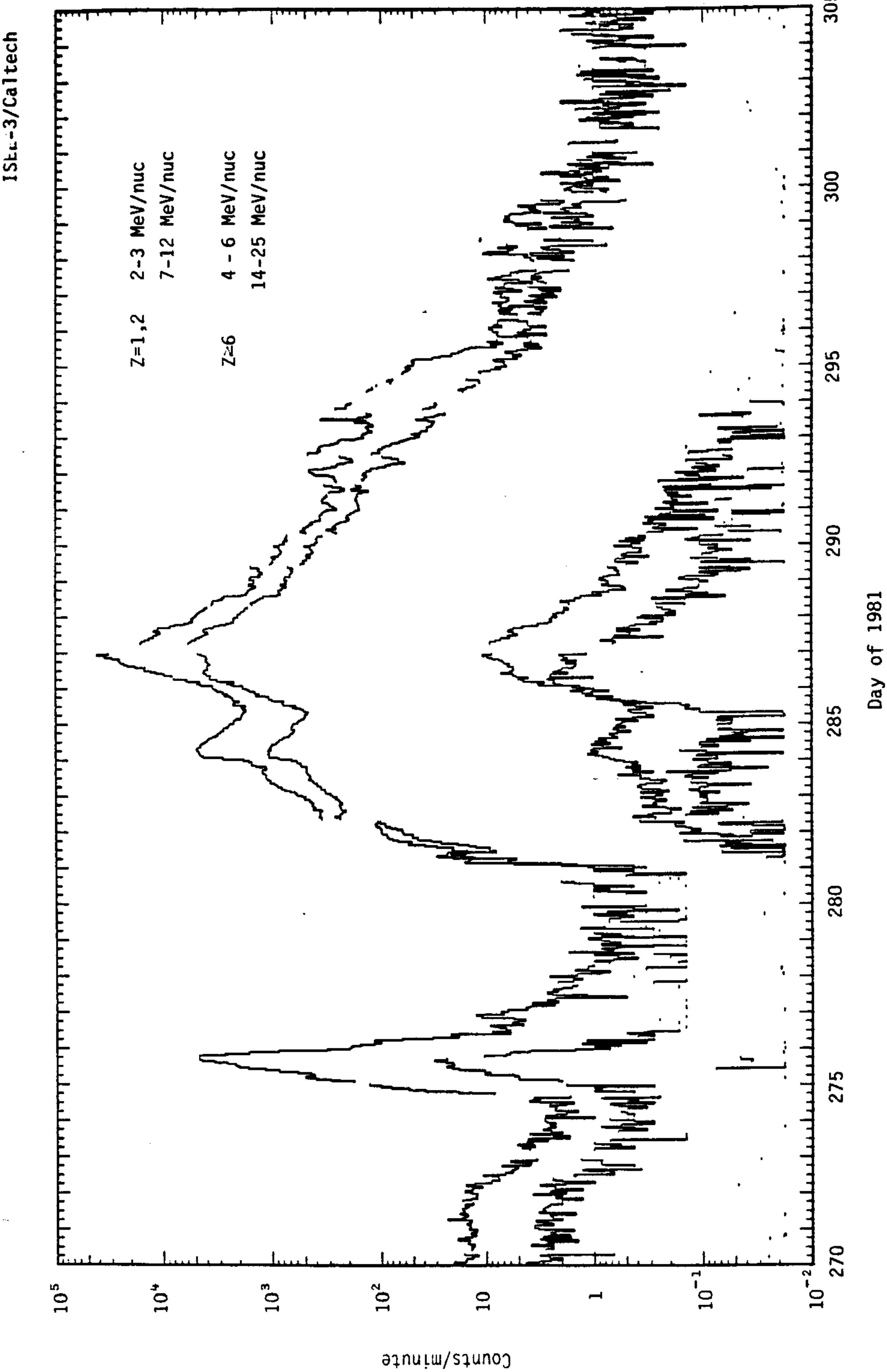


Fig. 1



10^5
10^4
10^3
10^2
10^1
p
α
HIST-I
HIST-II
FLUX (ARBITRARY UNITS)
10^0
10^1
10^2
10^3
E (MeV/Nucleon)

Fig. 2



ISEE-3/Caltech
Z=1,2 2-3 MeV/nuc
7-12 MeV/nuc
Z≥6 4 - 6 MeV/nuc
14-25 MeV/nuc
Counts/minute
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
270
275
280
285
290
295
300
305
Day of 1981

Fig. 3

VII. HIST Bibliography (12/31/82)

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